Appendix A:

```
Precalculation data processing:
@FOpen 'c:\tanager\multis.txt',1,FileNum
@For i = 1 To ACs
    @FRead
FileNum,EOF,AssetClass[i,1],AssetDesc[i,1],AssetCategory[i,1],TotalAssetsPct[i,1],ACAssetsTol[i,1],Appreciation[i,1],Dividend[i,1],
CapGainstax[i,1],Yield[i,1],CGDist[i,1],TaxBracket[i,1],Clt_Id,Turnover[i,1],CurrTax[i,1],CurrTaxDef[i,1]
    @If Turnover[i,1] = 0.0
        @Assign Turnover[i,1] = Horizon
    @EndIf
    @Assign YieldPlus1[i,1] = 1.0 + Yield[i,1]
    @rem debug YieldPlus1[i,1] + ' = ' + '1.0' + ' + ' + Yield[i,1]
    @Assign YieldPlus1[i,1] = YieldPlus1[i,1] ^ Horizon
    @rem debug YieldPlus1[i,1] + ' = ' + YieldPlus1[i,1] + ' ^ ' + Horizon
    @Assign HorizonMinus1 = Horizon - 1
    @Assign DividendPlus1[i,1] = Dividend[i,1] + 1.0
    @Assign AppreciationPlus1[i,1] = Appreciation[i,1] + 1.0
    @Assign ValueAfterTaxMult[i,1] = (Appreciation[i,1] + (Dividend[i,1] - (Dividend[i,1] * TaxBracket[i,1])) + (CGDist[i,1] -
(CGDist[i,1] * CapGainstax[i,1])))
    @rem debug ValueAfterTaxMult[i,1]
    @Assign ValueAfterTaxMultPlus1[i,1] = 1.0 + ValueAfterTaxMult[i,1]
    @Assign ValueAfterTaxMultPlus1[i,1] = ValueAfterTaxMultPlus1[i,1] ^ Horizon
    @rem debug  ValueAfterTaxMultPlus1[i,1]
    @Assign StockRate[i,1] = Appreciation[i,1] + Dividend[i,1] + CGDist[i,1]
    @Assign StockRatePlus1[i,1] = StockRate[i,1] + 1.0
    @Assign StockRatePlus1[i,1] = StockRatePlus1[i,1] ^ Horizon
    @Assign StockApprRateOnGoing[i,1] = Appreciation[i,1] - (Appreciation[i,1] * CapGainstax[i,1])
    @Assign StockApprRateOnGoingPlus1[i,1] = StockApprRateOnGoing[i,1] + 1.0
    @Assign StockDivRateOnGoing[i,1] = Dividend[i,1] - (Dividend[i,1] * TaxBracket[i,1])
    @Assign StockDivRateOnGoingPlus1[i,1] = StockDivRateOnGoing[i,1] + 1.0
    @Assign StockGrowthRateOnGoing[i,1] = Appreciation[i,1] + StockDivRateOnGoing[i,1]
    @Assign StockGrowthRateOnGoingPlus1[i,1] = StockGrowthRateOnGoing[i,1] + 1.0
    @Assign BondRateOnGoing[i,1] = Yield[i,1] - (Yield[i,1] * TaxBracket[i,1])
    @debug  BondRateOnGoing[i,1] + ' = ' + Yield[i,1] + ' - (' + Yield[i,1] + ' * ' + TaxBracket[i,1] + ')'
    @Assign BondRateOnGoingPlus1[i,1] = BondRateOnGoing[i,1] + 1.0
    @debug  BondRateOnGoingPlus1[i,1] + ' = ' + BondRateOnGoing[i,1] + ' + ' + '1.0'
    @Assign BondRateOnGoingPlus1[i,1] = BondRateOnGoingPlus1[i,1] ^ Horizon
    @debug  BondRateOnGoingPlus1[i,1] + ' = ' +  BondRateOnGoingPlus1[i,1] + ' ^ ' + Horizon
    @rem debug AssetClass[i,1] + ' ' + AssetDesc[i,1] + ' ' + TotalAssetsPct[i,1] + ' ' + ACAssetsTol[i,1] + ' ' + Appreciation[i,1] + ' ' +
Dividend[i,1] + ' ' + CapGainstax[i,1] + ' ' + Yield[i,1] + ' ' + AssetCategory[i,1] + ' ' + CGDist[i,1] + ' ' + TaxBracket[i,1] + ' ' + Clt_Id +
' ' + Turnover[i,1] + ' ' + CurrTax[i,1] + ' ' + CurrTaxDef[i,1]
    @Next I
```

Initialization

```
@rem debug 'Starting Initialisation...'
@DelFile 'C:\tanager\results.txt', 1

@Assign LethalValue = 0.0
@Assign ACsMinus1 = ACs - 1
@Assign Tmax = TotalAssets - TDmax
@Assign ValueBest = 0.0

@Do AllocateClasses_prc

@Do CurrentValue_prc

@Do WriteInitial_prc
```

AllocateClasses_prc

```
@rem **** PERCENT OF ASSETS IN EACH ASSET CLASS
@For i = 1 To ACs
    @Assign  ACAssets[i,1] = TotalAssets * TotalAssetsPct[i,1]
    @rem debug  ACAssets[i,1] + ' = ' + TotalAssets + ' * ' + TotalAssetsPct[i,1]
@Next I
```

CurrentValue_prc

```
@rem debug '**** DETERMINE VALUE OF CLIENT CURRENT ALLOCATION'
@For i = 1 To ACs
    @Assign ACT[i,1] = CurrTax[i,1]
    @Assign ACTD[i,1] = CurrTaxDef[i,1]
    @rem debug ACT[i,1] + ' ' +  ACTD[i,1]
@Next
i
@rem debug 'Doing  ValueForCurrent_prc'
@Do ValueForCurrent_prc

@For i = 1 To ACs
    @Assign ACTCurrBest[i,1] =  ACTBest[i,1]
    @Assign ACTDCurrBest[i,1] =  ACTDBest[i,1]
    @Assign ACValueCurrBest[i,1] = ACValueBest[i,1]
    @rem debug  ACTCurrBest[i,1] + ' ' + ACTDCurrBest[i,1] + ' ' + ACValueCurrBest[i,1]
@Next i
@Assign ValueCurrBest = ValueBest
@rem debug ValueCurrBest

@rem debug '**** REINITIALIZE'
@Assign ValueBest = 0.0
@For i = 1 To ACs
    @If AssetDesc[i,1] = 'Municipal'
        @Assign ACT[i,1] = ACTD[i,1] + ACT[i,1]
        @Assign ACTD[i,1] = 0.0
    @EndIf
@Clear Value
@rem InitArray ACT
@rem InitArray ACTD
@InitArray ACTBest
@InitArray ACTDBest
@InitArray ACValueBest
```

WriteInitial_prc

```
@rem **** WRITE INITIAL GENERATION FILE
@FOpen 'c:\tanager\initgen.txt', 2, FileNum

@rem for k = 1 To 50

@Assign ACInit[1,1] = CurrTaxDef[i,1]
@Str ACInit[1,1] , StgNum
@Assign  InitGen = StgNum

@For i = 2 To ACs
    @Assign ACInit[i,1] = CurrTaxDef[i,1]
    @Str ACInit[i,1] , StgNum
    @Assign  InitGen = InitGen + ', ' + StgNum
@Next i

@FWrite FileNum, InitGen
```

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```
@rem Next k

@FClose FileNum
```

5 Value Function

```
@Assign Value = 0.1

@rem **** The GA generates values for ACTD, and we calculate ACT
@For i = 1 To ACs
    @Assign ACT[i,1] = ACAssets[i,1] - ACTD[i,1]
    @rem debug  ACT[i,1] + ' = ' + ACAssets[i,1] + ' - ' + ACTD[i,1]
@Next i

@Do Lethal_prc

@Assign Terminate = 'No'
@IF Value <> LethalValue
    @rem **** Loop through all Asset Classes
    @For i = 1 To ACs
        @rem **** Check for Stock or Bond
        @If AssetCategory[i,1] = 'Stock'
            @Do ValueStock_prc
        @Else
            @Do ValueBond_prc
        @EndIf
        @Assign Value = Value + ACValue[i,1]
        @rem debug 'i = ' + i + #10 + 'ACTD[i,1] = ' + ACTD[i,1] + #10 + 'ACT[i,1] = ' + ACT[i,1] + #10 + 'Value = ' + Value + ' ValueBest = '
+ ValueBest
    @Next i
    @rem debug 'i = ' + i + #10 + 'ACTD[i,1] = ' + ACTD[i,1] + #10 + 'ACT[i,1] = ' + ACT[i,1] + #10 + 'Value = ' + Value + ' ValueBest = ' +
ValueBest
    @IF (Value <> LethalValue) AND (Value > ValueBest)
        @Assign ValueBest = Value
        @For i = 1 To ACs
            @Assign ACTBest[i,1] = ACT[i,1]
            @Assign ACTDBest[i,1] = ACTD[i,1]
            @Assign ACValueBest[i,1] = ACValue[i,1]
        @Next i
    @Endif
@ENDIF
```

Lethal_prc Procedure

```
@Assign Terminate = 'No'

@Assign TDTotal = 0.0

@For  i = 1 To ACs

    @If (ACTD[i,1] < 0) or (ACTD[i,1] > ACAssets[i,1])
        @Assign Terminate = 'Yes'
    @Else
        @Assign TDTotal = TDTotal + ACTD[i,1]
    @Endif

@Next i

@rem if (TaxBracket[i,1] = 0) and (ACTD[i,1] <> ACAssets[i,1])
    @rem Assign Value = LethalValue
    @rem Endif

@If (TDTotal > TDmax) OR (Terminate = 'Yes')
    @Assign Value = LethalValue
```

```
@EndIf
```

ValueStock_prc Procedure

```
    @rem **** COMPUTE SIMPLE FUTURE VALUE
5
    @Assign ACTDBase[i,1] = ACTD[i,1] * StockRatePlus1[i,1]

    @If Turnover[i,1] = Horizon
       @rem '**** TAXABLE STOCKS'
10
       @If OptMethod = 'Liq'
          @rem **COMPUTE BASE VALUE AT HORIZON
          @Assign BaseValue[i,1] = 1+Appreciation[i,1]+Dividend[i,1]+CGDist[i,1]
          @Assign BaseValue[i,1] = ACT[i,1] * BaseValue[i,1]^Horizon
15
          @rem ** COMPUTE TAXABLE CAPITAL GAIN
          @Assign AppreciationValue[i,1] = (1+Appreciation[i,1]+CGDist[i,1])
          @Assign AppreciationValue[i,1] = ACT[i,1] * AppreciationValue[i,1]^Horizon

20        @rem ** COMPUTE CAP GAINS TAX
          @Assign CapGainOnTaxableStocks[i,1] = AppreciationValue[i,1] * CapGainstax[i,1]

          @rem ** COMPUTE DIVIDENDS
          @Assign DividendVal[i,1] =  Dividend * TaxBracket
25        @Assign DividendVal[i,1] = 1 + Dividend - DividendVal[i,1]
          @Assign DividendVal[i,1] = ACT[i,1] * DividendVal[i,1]^Horizon

          @rem **** COMPUTE ACTUAL VALUE OF TAXABLE STOCKS
          @Assign ACTValue[i,1] = AppreciationValue[i,1] - CapGainOnTaxableStocks[i,1] + DividendVal[i,1]
30        @rem debug ' ACT[i,1]: ' + ACT[i,1] + #10 + ' BaseValue[i,1]: ' + BaseValue[i,1] + #10 + ' AppreciationValue[i,1]: ' +
AppreciationValue[i,1] + #10 + ' CapGainstax[i,1]: ' + CapGainstax[i,1] + #10 + ' CapGainOnTaxableStocks[i,1]]. ' +
CapGainOnTaxableStocks[i,1] + #10 + ' DividendVal[i,1]: ' + DividendVal[i,1] + #10 + ' ACTValue[i,1]: ' + ACTValue[i,1]

       @Else
35        @Assign ACTValue[i,1] = ACT[i,1] * ValueAfterTaxMultPlus1[i,1]
       @EndIf
    @Else
       @DO TurnOver_prc
    @EndIf
40
    @rem **** TAX DEFERRED STOCKS
    @If OptMethod = 'Liq'
       @Assign TaxOnTaxDefStocks[i,1] = ACTDBase[i,1] * TaxBracket[i,1]
       @Assign ACTDValue[i,1] = ACTDBase[i,1] - TaxOnTaxDefStocks[i,1]
45  @Else
       @Assign ACTDValue[i,1] = ACTDBase[i,1]
    @EndIf

    @rem **** FINAL VALUE
50  @Assign ACValue[i,1] = ACTValue[i,1] + ACTDValue[i,1]
```

ValueBond_prc Procedure

```
    @rem COMPUTE SIMPLE FUTURE VALUE

55  @Assign ACTDBase[i,1] = ACTD[i,1] * YieldPlus1[i,1]

    @rem **** TAXABLE BONDS
    @If OptMethod = 'Liq'
       @Assign ACTValue[i,1] = ACT[i,1] * BondRateOnGoingPlus1[i,1]
60     @rem debug i + ': ' + ACTValue[i,1] + ' = ' + ACT[i,1] + ' * ' + BondRateOnGoingPlus1[i,1]
       @rem Assign ACTTax[i,1] = (ACTValue[i,1] - ACT[i,1]) * TaxBracket[i,1]
       @rem Assign ACTValue[i,1] = ACTValue[i,1] - ACTTax[i,1]
    @Else
```

```
        @Assign ACTValue[i,1] = ACT[i,1] * BondRateOnGoingPlus1[i,1]
        @EndIf

        @rem **** TAX DEFERRED BONDS
  5     @If OptMethod = 'Liq'

        @Assign ACTDTax[i,1] = ACTDBase[i,1] * TaxBracket[i,1]
        @Assign ACTDValue[i,1] = ACTDBase[i,1] - ACTDTax[i,1]
         @rem debug ACTDTax[i,1] + ' = ' + ACTDBase[i,1] + ' * ' + TaxBracket[i,1]
 10      @rem debug  ACTDValue[i,1] + ' = ' + ACTDBase[i,1] + ' - ' + ACTDTax[i,1]
        @Else
         @Assign ACTDValue[i,1] = ACTDBase[i,1]
        @EndIf

 15     @rem **** FINAL VALUE
        @Assign ACValue[i,1] = ACTValue[i,1] + ACTDValue[i,1]
        @rem debug ACValue[i,1] + ' = ' + ACTValue[i,1] + ' + ' + ACTDValue[i,1]
```